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By - Soule, A. Bradley

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Recent Department of Labor and Public Health Service reports indicate that there are presently 72,000 people operating x-ray equipment in this country of whom 33,000 are registered technologists. It is estimated that by 1975 there will be a need for 100,000 technologists of whom at least 52,000 should be fully trained. Almost all formally trained technologists are being produced by the 1,200 hospital schools approved by the American Medical Association Council on Medical Education which provide courses 24 or more months in length, and more than 90 percent of which are terminal without college affiliation. There are approximately 60 colleges and universities (mostly community or junior colleges) which offer associate degree programs and a dozen which have developed or are developing baccalaureate degree programs. It is hoped that the college affiliated programs will produce more and more of the technologists of the future. The American Medical Association Council on Medical Education has made available "Essentials of an Approved School of Radiologic Technology" and "Essentials of an Approved School of Technologists in Radiation Therapy." The publication of "Essentials of an Acceptable School for Nuclear Medical Technicians and Technologists" is anticipated. (JK)

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THE ROLE OF JUNIOR COLLEGES IN EDUCATIONAL
PROGRAMS IN RADIOLOGIC TECHNOLOGY

A. Bradley Soule, M.D. *

During the past decade there has been an unprecedented increase in the number of junior college programs in the country, these having tripled since 1957. There are currently 923 junior colleges and soon there will be over 1,100. Many of these are also increasing in size of student enrollment, especially in certain areas of the country in which the population is expanding rapidly. One example is Dade County Junior College in Miami, Florida, which in 1967 had nearly 14,000 students, but which anticipates quadrupling its enrollment within the next ten years.

Understandably, many of these schools are becoming heavily involved with career or occupational programs in the allied health fields such as nursing, physical therapy and rehabilitation, medical and radiologic technology, as well as other paramedical fields.

At the same time, hospitals, which historically have produced largely at their own expense most of the workers in these fields, have been faced with escalating costs of rendering patient care. Persuasive evidence is being presented that educational programs, especially in nursing and to a lesser extent in the technological fields allied to medicine, should be the responsibility of colleges and universities, and supported by public and private funds, and not by the patient's dollar.

Hospitalization insurance agencies are taking a similar stand and at least one legal action is pending in which a hospital is suing Blue Cross for payments withheld because the insurance carrier claimed that part of the payment requested

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by the hospital was used to support educational programs, not directly related to patient care.

In the field of radiologic technology, the problem has been compounded by the increasing demand for radiologic services and by the complexity and amount of time consumed by many of the examinations. These factors, together with the realization by radiologists, radiation physicists, radio-biologists, and public health officials that protection of patients and their progeny from possible hazards of unnecessary radiation emphasize the need for providing adequate educational programs for workers who are administering radiation to patients. Radiologic technologists administer most of the radiation used in hospital and medical practice today with the exception of fluoroscopy, radiation therapy, and certain nuclear medical procedures.

Almost all of the formally trained technologists are produced by the 1,200 hospital based schools accredited by the Council on Medical Education of the American Medical Association. These schools provide courses 24 or more months in length, more than 90 per cent of which are terminal without college affiliation, and with no college credit given for courses offered. In 1967, the AMA approved schools turned out 5,400 graduates. At the same time there were less than 100 technologists who received associate degrees, and about a dozen who received bachelor's degrees.

According to the best information now available, there are approximately 60 colleges and universities (mostly community or junior colleges) offering associate degree programs, and a dozen or less which have developed or are developing baccalaureate degree programs in radiologic technology.

The hospital-based programs have been especially appealing to young people from low income families that cannot afford to send their children to college.

In order not to lose this pool of promising workers, it is imperative that as more junior college programs in radiologic technology are developed, ways and means be found of keeping tuition charges to a minimum and of providing scholarships and loan funds for needy students.

In a few states the junior colleges are sufficiently subsidized so that students may go from high school into college with minimal financial commitment. Many, however, require an investment of several thousand dollars or more for a two year program.

The professionals in the field of radiology and radiologic technology believe that the most promising sources of staff technologists in the foreseeable future are the hospital based schools, since they are now providing 98 per cent of current graduates.

It is hoped, however, that the college-affiliated programs will produce more and more of the radiologic technologists of the future, especially if hospitals tend to drop out of the educational field. This is still an unproven hypothesis, and there is a calculated risk that increased costs to prospective students and drop-outs while in training may offer a real threat to the success of this venture.

The Department of Labor and the Bureau of Health Manpower of the Public Health Service have recently issued reports ^{1, 2, 3} in which they note that there are approximately 72,000 people operating x-ray equipment in this country, of which 33,000 are qualified registered technologists. The Department estimated that by 1975 there will be a need for 100,000 technologists, of whom at least 52,000 will or should be fully trained.

The number of AMA approved schools increased from 456 to 1200 in the last decade, with a corresponding increase in training capacity from 3,600 to 14,000, and increase in number of graduates from 1,800 to 5,400.

Unfortunately there is a high attrition rate, primarily due to marriage of female technologists who spend an average of 3 ½ years in the field, this including their training period. The relatively low salary scale and the paucity of opportunities for advancement have tended to attract relatively few men, and a number of male technologists have left for more remunerative positions in commerce and industry. Since most males entering the field do so with the expectation of making a lifetime career of radiologic technology, the majority do remain. It has been estimated that well over half of the administrative and chief technologist positions in the country are filled by men.

Certainly one of the real needs is for development of middle management positions and for teachers who are also in exceedingly short supply. General duty technologists receive salaries which are usually equated to other comparable staff workers in hospitals, but there seem to be increasing opportunities for advancement in rank and responsibilities with corresponding increases in salaries and perquisites. The junior colleges should play a significant role in the development of the higher echelon types of technologists in providing them with a general basic education -- one that will permit talented young people to move on up the educational ladder.

Equivalency tests are being developed which should enable qualified technologists already in the field to obtain college credits for knowledge acquired in their schooling and employment. Northeastern University has developed an interesting plan, whereby technologists employed in the Boston area may take evening courses which will lead over a period of several years to the granting of an associate degree.

While the need is greatest for technologists in the field of diagnostic x-ray, there is also an increasing demand for technologists in radiation therapy

and nuclear medicine, and for such specialized workers as radiologists' assistants, special procedures technologists, administrative assistants, electronics and engineering technologists.⁴ Colleges and universities will undoubtedly play a leading role in development of many of these specialists, but of necessity with the collaboration of the staffs of clinical radiology departments.

The Council on Medical Education of the American Medical Association is charged with the responsibility for granting approval of programs of instruction in radiologic technology. They establish standards of training which are expressed in the "ESSENTIALS OF AN APPROVED SCHOOL OF RADIOLOGIC TECHNOLOGY", copies of which may be obtained from the Council's office. The "Essentials" outline the Council's requirements for administration, organization, faculty, admission requirements, curriculum, ethics, etc., for qualification as an approved school. Recently, the American Medical Association has created a Department of Allied Medical Professions and Services within the Division of Medical Education. This new department will supervise the broad field of educational programs in the paramedical areas.

The American College of Radiology, through its Commission on Technologist Affairs, assists the AMA Council by keeping under constant study the changing needs in the field of radiologic technology, and by conducting survey inspections of schools of radiologic technology to evaluate such schools and make recommendations regarding approval of their programs. The Commission has developed a Committee on Technologist Training, a Committee on College Affiliated Training, a Committee on Training in Nuclear Medicine Technology, and a Committee on Training in Radiation Therapy Technology, all of which act as study committees in their fields. The Committee on Technologist Training, which includes both radiologists and technologists, handles the details of the survey inspections.

The American Society of Radiologic Technologists, acting largely through its Education Committee, also keeps under surveillance educational needs and advises the College and AMA Council regarding desired goals, standards, details of curriculum, etc.

The American Registry of Radiologic Technologists, an independent agency which derives its membership from radiologists appointed by the American College of Radiology and from technologists named by the American Society, conducts a program of examination and certification of qualified graduates of approved schools. Since its organization the Registry has certified qualified candidates in general radiologic technology; in 1962 they added certification in radiation therapy technology and in nuclear medicine technology. Since July 1, 1966, the Registry has allowed only those candidates who have successfully completed 24 or more months in an AMA approved training program to take the examinations in radiologic technology.

Recently developed are the "ESSENTIALS FOR AN APPROVED SCHOOL OF TECHNOLOGISTS IN RADIATION THERAPY", which provide guidelines and requirements for training of technologists in this area.

The field of nuclear medicine technology engages the interest of not only the radiologic groups but also crosses speciality lines so that in the planning of educational programs for technologists in this relatively new field, the American Society of Clinical Pathologists, the Society of Nuclear Medicine, the American Society of Medical Technologists, the American College of Radiology, and the American Society of Radiologic Technologists are equally concerned. It is anticipated that there will soon be an "ESSENTIALS OF AN ACCEPTABLE SCHOOL FOR NUCLEAR MEDICAL TECHNICIANS AND TECHNOLOGISTS" developed by the AMA Council which will utilize a Board of Schools made up of representatives of all of the above listed

organizations to assist the Council in survey inspections and evaluation of schools of nuclear medicine technology. Under consideration are two general types of programs -- one which may or may not lead to an associate degree for "technicians" and one which leads to a baccalaureate degree for "technologists". Currently, registered radiologic or medical technologists may enroll in a course in nuclear medical technology of twelve or more months in length, and may, if their qualifications are acceptable to the Registry Boards, receive additional certification in nuclear medical technology. Certification may be granted by either the American Registry of Radiologic Technologists or the American Society of Clinical Pathologists through its Commission on Medical Technology. Under study is an additional type of training under which nuclear medical technologists may be developed directly without prior training in radiologic or medical technology. Minimal standards have not as yet been formalized for this new program, but it is anticipated that criteria quite similar to those for radiologic technology will be developed.

The AMA Council will only approve schools which are organized in colleges of medicine or in radiology departments affiliated with accredited general hospitals. Under consideration is a revision which, if adopted, will provide for the development of schools in specialty hospitals or in educational facilities other than those named above which have demonstrated capabilities of providing suitable training in radiologic technology.

Thus, it is essential that, in the development of a college affiliated program, the hospital school or schools must apply to the AMA Council on Medical Education for approval, naming the college as the affiliate. Both the hospital school or schools and the college shall be held to the required standards. Provisional approval may be granted to the combined school program without an on-site survey

if the program appears to meet all of the requirements of the AMA Council. Survey inspections of the college and hospital programs will be conducted by a team representing the ACR Committee on Technologist Training in not less than one year nor more than two years after provisional approval has been granted.

The organization and operation of the school of radiologic technology shall be the joint responsibility of the college and of the radiology department or departments of the cooperating hospital or hospitals. The school may carry the names of all affiliated organizations if desired.

Each hospital shall be fully accredited by the Joint Commission on Accreditation and the Radiology Department must provide a wide variety and a reasonable volume of radiologic procedures. If the department is unable to offer acceptable experience in specialized procedures and/or in radiation therapy, affiliation shall be established with an institution providing such experience. At least 2,400 hours of hospital based practicum shall be provided. Time used in work on phantoms and other inanimate objects shall not be granted credit toward the 2400 hours of the practicum.

A qualified radiologist shall be responsible for the organization and conduct of the School of Radiologic Technology. This will require staff appointment at the College and full time or nearly full time appointment at the Hospital. Should more than one hospital be affiliated in the program, it may be necessary or advisable for a radiologist to be appointed for each hospital. In such a case, the radiologists should comprise a committee which oversees the entire program.

A full time qualified radiologic technologist shall be on the staff of the College, who will work in cooperation with the affiliated hospital or hospitals to coordinate the entire program in all institutions involved.

It is the responsibility of the colleges to teach some of the courses in the technical field. Courses required for the granting of degrees in "logic technology" courses will depend on the college faculty to develop and present them to the student. In some cases this can be done. Usually courses will require supplementation in the hospital radiology department so that they function as the clinical laboratories for the opportunity of working with patients. Since handling seriously ill and injured patients and logic examinations, including a number which require experience must extend over a period long enough.

It is currently required that training in college affiliated schools extend over a total of 2400 hours. In the college affiliated programs granting degrees it is possible to develop a well rounded experience. It has long been the impression of the professional technologists that at least 2400 hours should be spent in a hospital environment and that this is a minimum for all schools. In the hospital based terminal programs, 2400 hours.

In developing a program with a junior college affiliation, details is possible. A common pattern is one year in college for four semesters, this being followed by two years in a hospital.

hospital radiology department school. In such a case the hospital school must assume responsibility for the practical training and work experience, including not over two months in the darkroom. The hospital school must also provide at least two hours a week of didactic instruction. Near the close of training, review sessions should be provided either by the hospital school or the college. Film critiques should be conducted at least once a week during the hospital experience.

In another pattern, which is only possible if the college and the hospital are in close proximity, the student spends part of his time in the college and part in the hospital throughout the training period.

There are variants of both of these basic plans.

Certain guidelines have been established to assist in the development of an integrated plan for conduct of the school. Because of the many individual variations in program operation, it is necessary that each be evaluated on its own merits. The Committee on Technologist Training recognizes that, while there must be room for individual differences in the method of operation, all programs must function at or in excess of certain minimum standards. These standards or guidelines have been imposed after careful thought to fulfill a twofold purpose: first, to provide a channel for schools to follow in completing objectives favorable to the profession and, second, to provide a means for responsible control of the quality of technologists produced and their performance in the profession.

The objective in all programs must be to provide an educational experience of sound academic value balanced between theory and practice. The combined affiliated program must be so organized and integrated as to accomplish this objective.

Directors of schools are therefore urged to offer courses that will meet all requirements for an associate degree, and will also provide on a college level the technical courses outlined in the AMA Basic Minimum Curriculum. Time should be allowed for study, recreation, holidays, and vacations. The program must include

didactic and applied training in radiologic technology adequate in course content and in length, breadth, and depth of clinical experience, sufficient to fully prepare the student for a professional career in this field. Not over 40 hours per week should be devoted to the practicum.

The course material and practicum must be designed to insure that graduates are qualified for registration by the American Registry of Radiologic Technologists.

Selection of students for the school shall be the joint responsibility of the college and hospital or hospitals. Efforts should be made to recruit students who show an aptitude for radiologic technology, and who have desirable traits of character, personality, and intelligence. Unpromising applicants should be discouraged. Aptitude tests, relative class standing in secondary schools, references, and personal interviews should be used in evaluation of candidates.

All didactic courses, whether provided by the college or hospital, should be of college credit quality. These shall include courses required in the AMA Basic Minimum Curriculum or those of equivalent content.

The college is encouraged to offer background courses in subjects designed to prepare graduates for teaching and supervisory positions in radiologic technology.

If all of the required courses are not taught in the college, the remainder must be given in the hospital school.

The subject material of courses to be taught should follow the outline in the Teacher's Syllabus, published by the American Society of Radiologic Technologists, except that this may be varied by instructors to provide each student with a well rounded background in the science and art of radiologic technology.

Careful attention shall be paid to the organization of the practicum which will be provided in the hospital radiology department. This should provide a meaningful educational experience. Students must be given thorough instruction in

the operation of equipment and in the handling of all patients, especially the seriously sick and injured, before being permitted to perform such examinations. They shall practice first under close supervision, then under general supervision, and finally unaided. Each student must be taught the principles and application of radiation safety and of general safety. The student shall not be permitted to perform an x-ray examination until this can be done with safety to the patient and to the personnel in the department. Practical experience should not include excessive time in duties which involve a minimum of learning, such as darkroom work, filing, typing, transportation of patients, etc.

Each student shall be provided with a workbook wherein are recorded procedures which the student performs. Before graduation, each student shall be required to perform a suitable number of examinations in multiple categories, at least one third of which shall have been made unaided.

The school shall not permit those students to graduate or to be certified as eligible for registration by the American Registry of Radiologic Technology who have failed to complete satisfactorily courses listed in the Basic Minimum Curriculum.

The radiologist directing the program shall certify each student candidate for graduation as being technically competent in order for the student to be graduated.

Records of students' activities and accomplishments must be complete and readily available for inspection teams when they come to appraise the educational program.

The Committee on Technologist Training and the Committee on College Affiliated Programs welcome inquiries from radiologists directing hospital departments of

radiology and from administrative officers of colleges and universities regarding projected programs in radiologic technology, and will gladly furnish advice and help in organizing affiliated schools. Inquiries should be directed to the American College of Radiology, 20 North Wacker Drive, Chicago, Illinois 60606, or to the Council on Medical Education, American Medical Association, 535 North Dearborn Street, Chicago, Illinois 60610.

Information regarding registration of radiologic technologists may be obtained from the American Registry of Radiologic Technologists, 2600 Wayzata Boulevard, Minneapolis, Minnesota 55455.

Copies of the Teacher's Syllabus and Basic Minimum Curriculum may be obtained for \$3.50 postpaid from the Executive Secretary, American Society of Radiologic Technologists, 537 South Main Street, Fond du Lac, Wisconsin 54935.

* Dr. Soule is Chairman of the Department of Radiology, University of Vermont College of Medicine, and also Chairman of the Committee on Technologist Training, American College of Radiology.

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